

MSC Apex Generative Design

Bridge the gap between design and manufacturing with Smart Generative Design



At a glance

MSC Apex Generative Design is the fully automated generative design solution built on the most intuitive CAE environment in the world, MSC Apex. It exploits all the easy-to-use and easy-to-learn features of MSC Apex while employing an innovative generative design engine in the background. Thus, it dramatically decreases the effort required in the design optimisation workflow.

Simplicity

No expert knowledge required for conducting optimisations through a high user-focused software design

Automated design

Almost automatically generate multiple smoothed design candidates that all satisfy the design criteria while minimising the weight.

Import and validation

Import existing geometries or mesh, find optimised design candidates, and perform design validation - all inside a single CAE environment.

Direct output

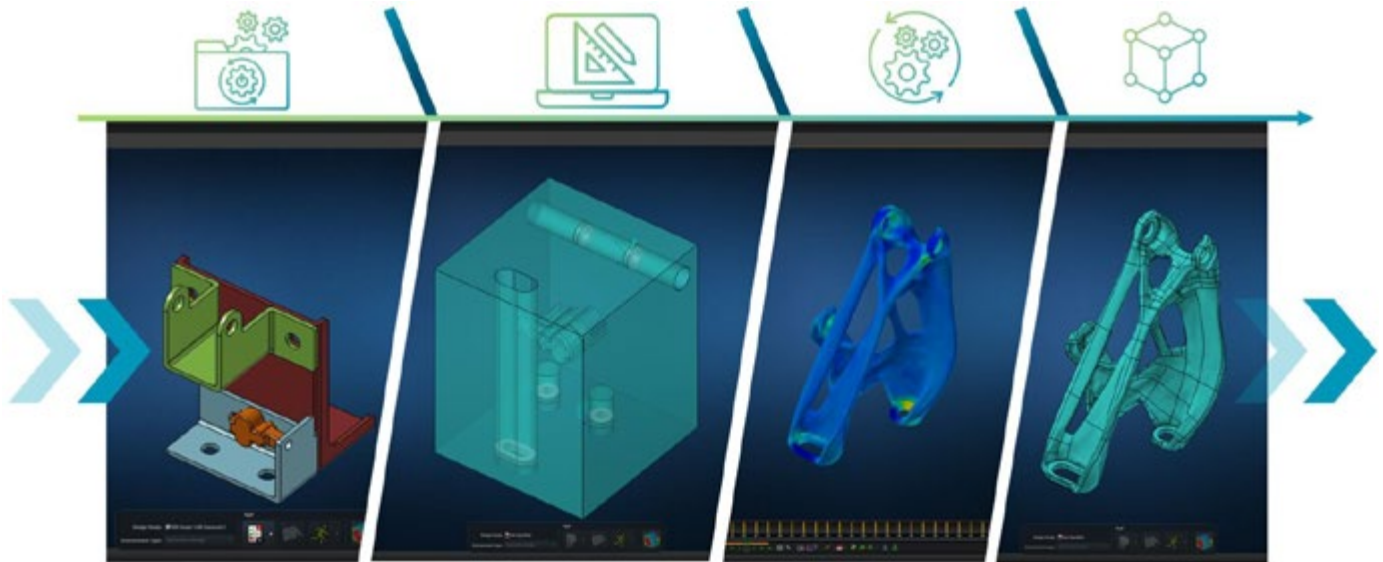
Transfer the result to NURBS and export it in CAD standard format. The geometry can be directly manufactured and used immediately without manual re-work

One process

Import the resulting geometries in Simufact Additive or Digimat AM to achieve cost-efficient first-time-right result for every part

MSC Apex Generative Design

One fluid, integrated optimisation workflow



Import geometry

Existing CAD data can be directly imported into MSC Apex Generative Design. The import feature can handle all common CAD file formats, from STL and STEP files through to a number of proprietary CAD software file formats. If needed, even complex assemblies can be imported. Otherwise, the model can be created from scratch directly within the software.



Geometry preparation and boundary conditions

Using the versatile geometry tools, the imported data can be easily manipulated for preparing the optimisation model. Specialised functions allow the highly efficient preparation of complex assemblies. Loads and boundary conditions are quickly defined with the corresponding features to complete the model setup.



Automated and rapid optimisation

The software automatically creates a mesh within seconds and starts the optimisation run. It intelligently smooths and properly intersects the geometry in every iteration. And the algorithm creates feasible, directly usable and reliable designs.



Direct retransition to CAD

With just a few mouse clicks the generated mesh is quickly transferred to a NURBS-based CAD file format, so that it can be utilized in the user's common CAD/CAM workflow – no more manual work required!

Benefits

MSC Apex Generative Design



Significant time reduction

MSC Apex Generative Design makes design for manufacturing smarter because it combines speed with high levels of automation to significantly reduce the time required for optimisation. The result is a fast, cost-efficient and integrated process.



Stress constraint based optimisation

Stresses are usually the most important layout criterion for a part design. MSC Apex Generative Design technology makes it possible to optimise in a stress-oriented manner. This approach enables a true bionic-shaped design, with a very homogenous stress distribution to ensure high part reliability.



Automated retransition to CAD

Conventional optimisation software requires the use of additional retransition software to receive computer-generated structures, and the know-how and experience to use it. MSC Apex Generative Design incorporates this core functionality in a single environment and automatically translates the design for optimal CAD/CAM linkage



Intelligent smoothing

The efficient transition into fine and smooth surfaces is automatically conducted by an intelligent algorithm. A defect-free surface is guaranteed, ensuring the high quality of every single part.



Automatic mesh generation

The mesh for the optimisation model is automatically generated and error-free compared to a manual, time-consuming process using conventional optimisation software



Simulating non-isotropic materials

Besides isotropic material, MSC Apex Generative Design can also simulate 3D transversely isotropic and 3D orthotropic material for FFF 3D printing. Based on Tsai Hill and Tsai Wu failure criteria, the user can take directional dependencies into account.



Highest resolution with automatic adjustment

MSC Apex Generative Design is designed specifically to generate the detailed and highly complex structures that only additive structures can manufacture. The software automatically adjusts the resolution: once a rough geometry has been generated, the software increasingly refines the resolution until a finer, more detailed structure is achieved.

Design for Additive Manufacturing (DfAM) without expert knowledge

MSC Apex Generative Design is designed specifically to generate the detailed and highly complex structures that only additive processes can manufacture. The optimised designs exhibit perfect transitions between structure elements such as struts and shells as well as they contain usually self-supporting structures that ensure the results can be sent straight to print.

However, in cases where further manufacturing and design validation is necessary, MSC Apex Generative Design is interoperable with Simufact Additive, Digimat AM, and MSC Nastran. The advantages of this innovative software are compelling:

Advantages



No expert knowledge required – optimisation is highly automated



Multiple design candidates generated based on optimisation settings



The results are always smooth and **tailored for a direct additive manufacturing** production



Interoperability for validation of mechanical integrity and manufacturability



Cost savings through a much more **efficient and innovative** process of product design

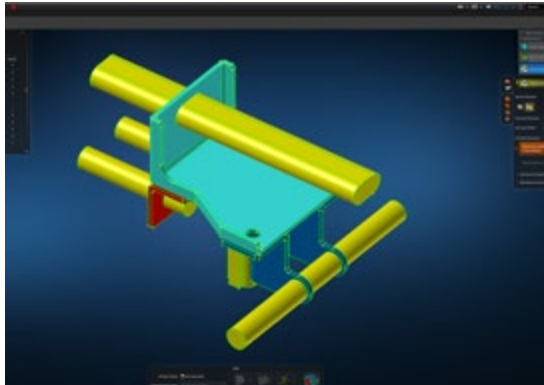


“DfAM is the value multiplier for AM because it is the fastest way to move down (these) cost curves.”

Timothy W, Simpson, Paul Morrow
Professor of Engineering Design & Manufacturing, Pennsylvania State University

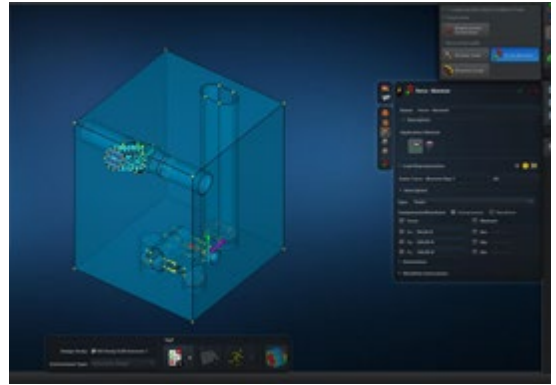


Built for productivity and ease



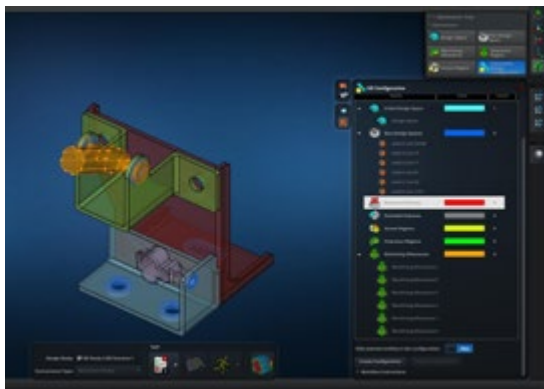
Design space creation workflow

Try out the new geometry tools “access & clearance region” for the quick creation of a complex design space



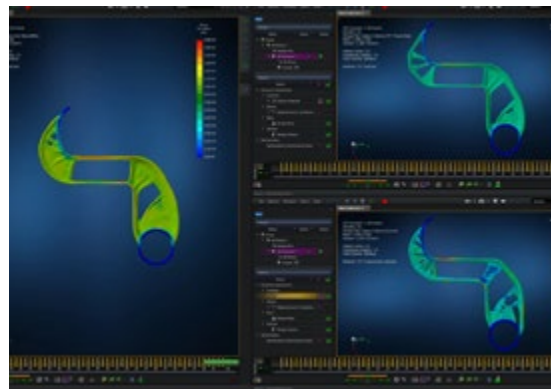
Assembly support

Set up optimisation for assemblies with the right tools and guided workflow



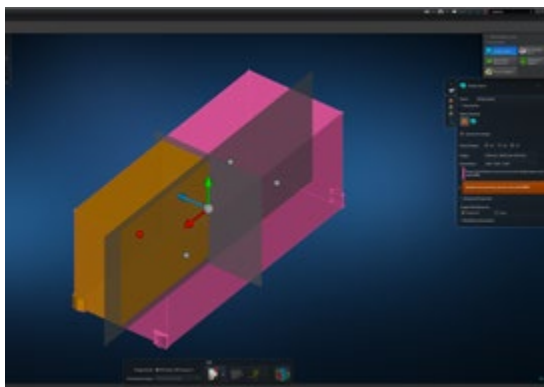
Retained volumes

Consider other parts of the assembly including their LBCs and materials



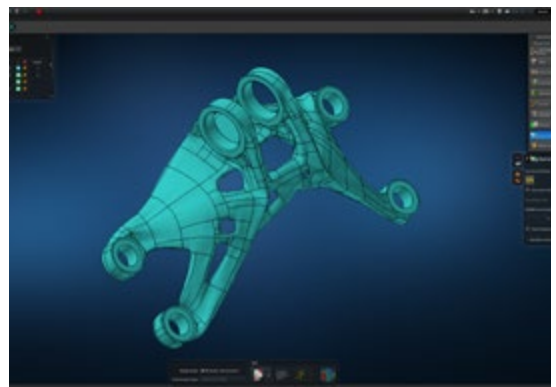
Non-isotropic material

Consider directional dependencies within the simulation for 3D transversely isotropic and 3D orthotropic material



Symmetry constraint

Set up symmetric optimisation models easily and produce designs faster than calculating full models



Facet-to-NURBS retransition

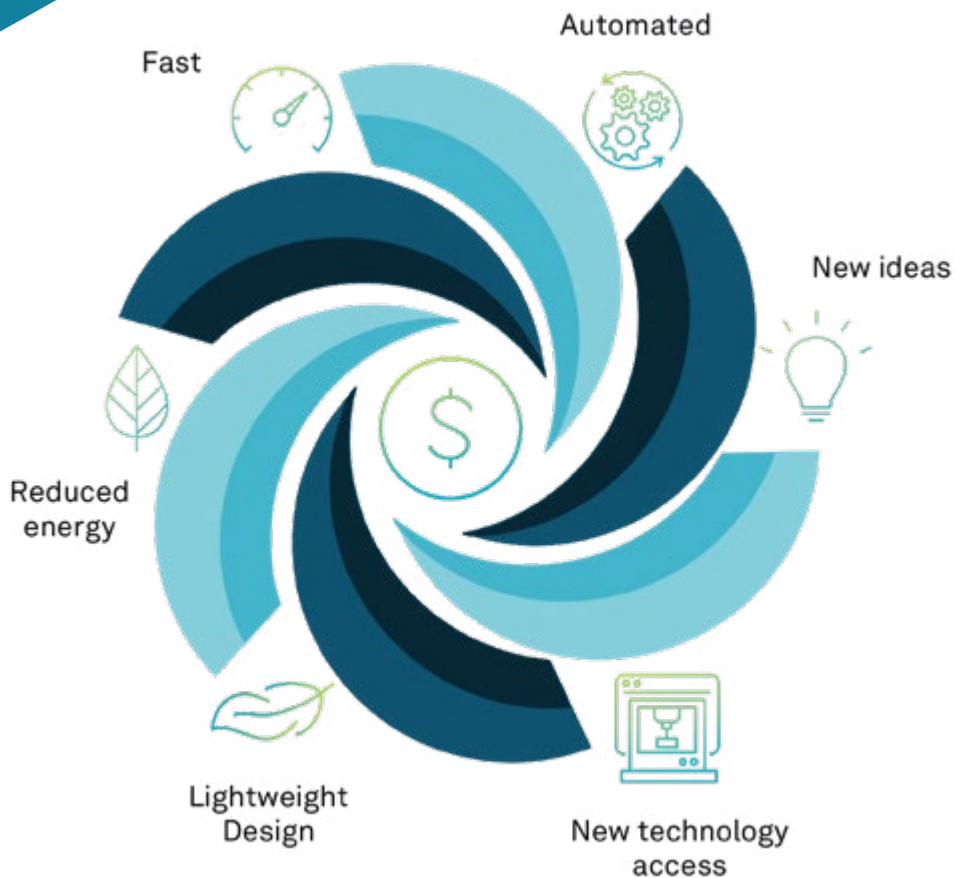
Convert the generated mesh to a NURBS-based standard CAD file format in a single, automated step

Innovative products from various industries

Optimisations can significantly improve a part's performance. One of the major benefits is that, with a lightweight design, the part saves material in production and, by reducing the weight, energy consumption can be considerably lowered during manufacturing and operation. Yet it also allows for machines to be more productive: by reducing moved masses, the machine can run faster and be more efficient. But product optimisation can also improve further aspects of a part: it can increase the stiffness, lower the overall stress level within the part, reduce assembly effort through integrated part design and more!

Therefore, optimisation is relevant for almost every industry. In particular, space technology, motor racing and aerospace benefit extensively from lightweight products, and driven by electric mobility, it's becoming more and more important for automotive, too. In addition, robotics and automation is a growing market with high needs for lightweight solutions. Additive manufacturing also benefits from the bionic-shaped geometries, which are vastly improved and more cost-efficient to produce compared to conventional designs.





Design your costs

MSC Apex Generative Design makes it possible to design the costs of a part. Designs are no longer solely focused on the manufacturability but function-oriented and purpose driven. Through lightweight design material within production can be saved, reducing time and costs of the print. The lower weight can help save resources within operation.

The highly automated process with clever algorithms enables a very fast optimisation run. The easy and time-efficient model set-up in combination with a high-speed simulation makes it possible to generate several design concepts from which the most promising and cost-efficient one can be chosen given the further requirements such as material and

processes etc. The low time effort reduces overall costs in product design and shortens the time-to-market.

While offering a lot of potential through its freedom of design, faultless 3D printing is still very difficult to achieve when the design is not perfectly adapted to the technology's needs. Generating designs tailored for Additive Manufacturing, the access to this promising technology even without expert knowledge is enabled by MSC Apex Generative Design. The organic shaped designs created by the software, also lead to new ideas and new solutions, driving innovation for the company. Applying MSC Apex Generative Design saves costs at every stage of the product's lifecycle!

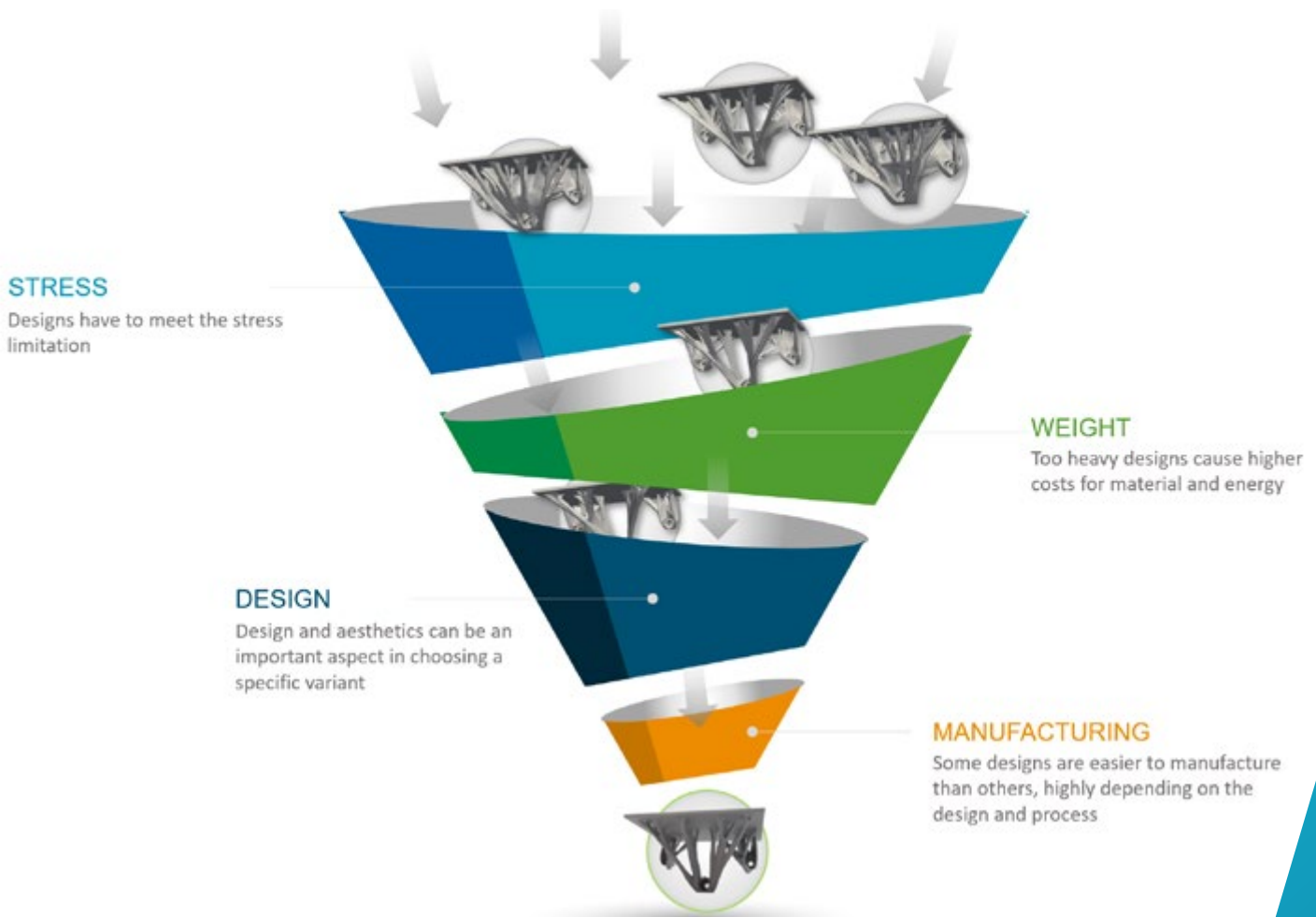
Explore the design space and rapidly create optimised parts

MSC Apex Generative Design enables the free-flowing optimisation of ideas and feasible design possibilities. This is the fundamental principle behind truly new, innovative designs. These smart designs are driven by intelligent algorithms rather than the standard serial design procedure based on legacy designs.

A single derived design solution pales in comparison to the exploration of several designs that undergo the MSC Apex Generative Design funnel to identify the most promising one. The ability to explore design space in a time-efficient manner ensures that the design process does not become a bottleneck and thus allows our

users to make decisions based solely on design criteria.

With MSC Apex Generative Design, the user needs only to define the objectives, criteria, and constraints within the design space the user wishes to explore. Based on the input, a variety of results can be generated in a short time. Criteria such as stress limit, weight target, aesthetics and manufacturability are assessed to determine the best option for the given requirements. This bridges the gap between design and manufacturing and overall reduces time-to-market.

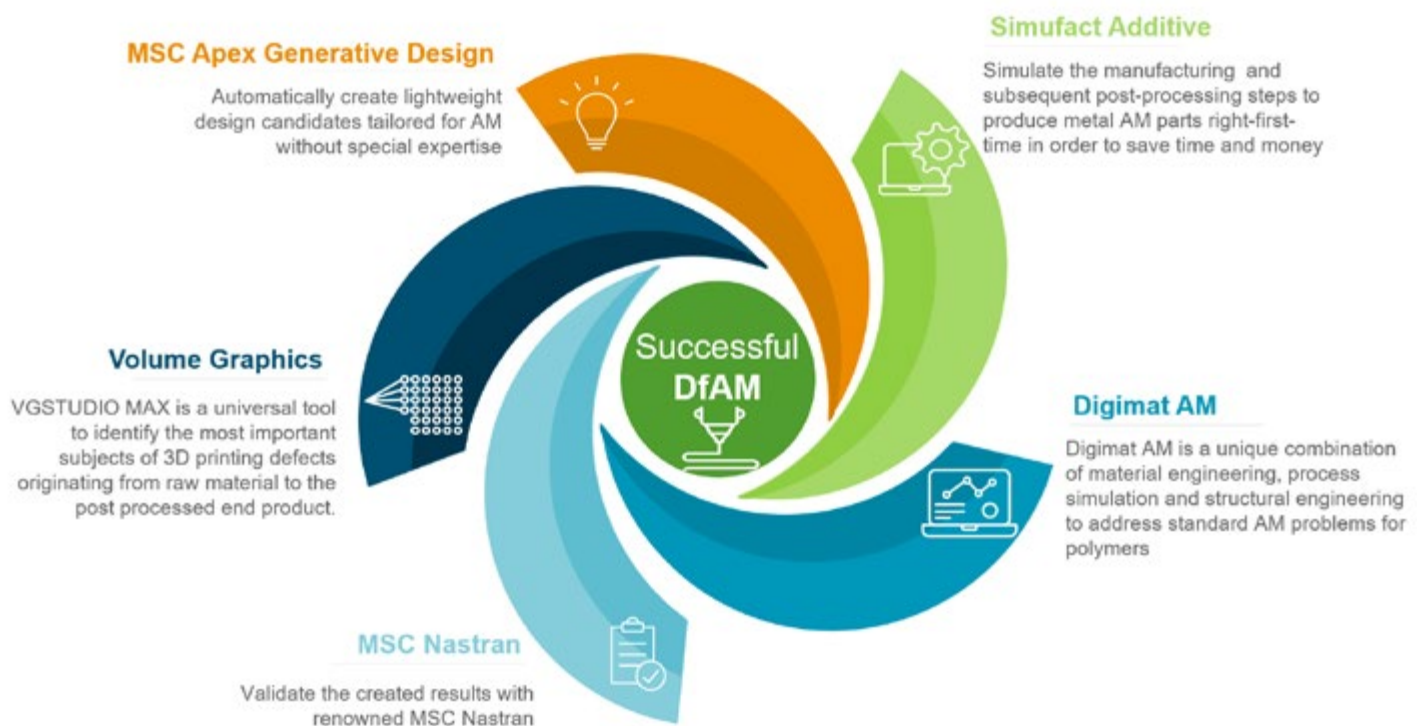


Design end-to-end process through interconnected products

Hexagon Design & Engineering offers a complete solution for a successful design within additive manufacturing. Starting with the design of optimised, lightweight parts, the geometry can then be transferred to the simulation of the manufacturing process, either Simufact Additive for metal parts, or Digimat AM for polymer production. The software analyses the part's behaviour during manufacturing, checks for any defects that may occur and optimises parameters to reduce manufacturing-induced stresses and deviations.

The results created can finally be checked with industry-recognised MSC Nastran to validate that the part meets all given requirements. After production, the part's integrity can be ensured with the gold-standard in CT analysis, VGSTUDIO MAX by Volume Graphics. The target/actual performance comparison shows any deviations, while details of pores and residual stresses can also be evaluated and much more!

From load simulation, design generation, manufacturing simulation, and verification, all elements must be integrated into one fluent workflow. Every stage is a vital part of a successful product lifecycle. Simulation reduces failures and increases performance, it drives innovations and first-time-right production – so start now!

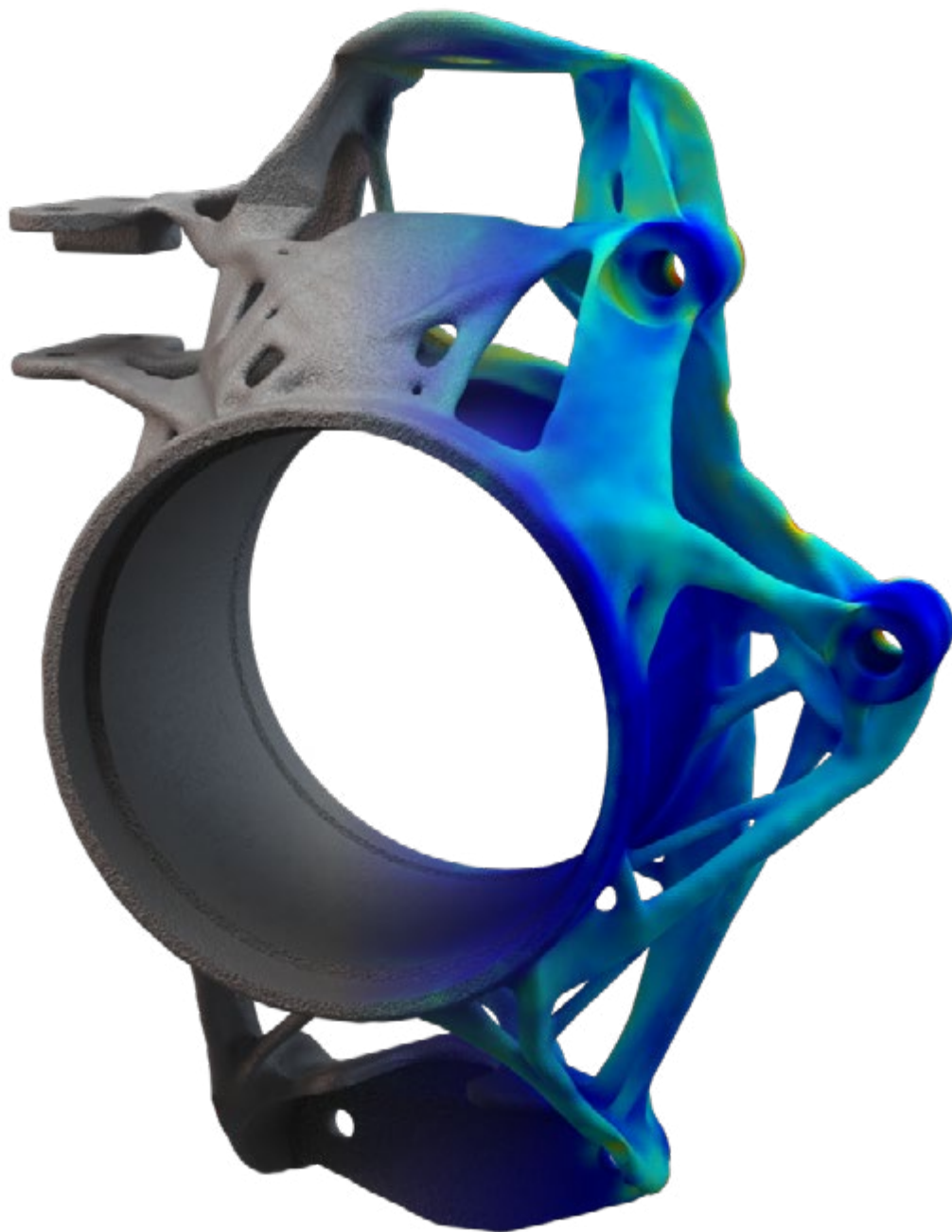


Simulation driven design



With the ease of use and optimization speed, we see MSC Apex Generative Design as a game changer for EDAG. We can now generate even more lightweight designs in a fraction of time. This efficiency really pushes our product development.”

Lucas Epperlein
EDAG





Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

MSC Software, part of Hexagon's Manufacturing Intelligence division, is one of the ten original software companies and a global leader in helping product manufacturers to advance their engineering methods with simulation software and services. Learn more at [mscsoftware.com](https://www.mscsoftware.com). Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production and metrology to make manufacturing smarter.

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